CLAIMS

I claim:

1. An apparatus for modifying a workpiece, the apparatus comprising:

a focused laser system to produce a focused laser;

a workpiece former having a complex shape to which the workpiece substantially conforms; and

a positioner that makes an adjustment to keep the focused laser substantially focused on the workpiece as the positional relationship between the workpiece former and the focused laser system changes to an operating position that alters the distance between the workpiece and the focused laser system due to the complex shape of the workpiece former.

2. The apparatus of claim 1, wherein the adjustment is made by moving the workpiece former in a direction that changes the distance between the workpiece former and the focused laser system.

3. The apparatus of claim 1, wherein the adjustment is made by moving the focused laser system in a direction that changes the distance between the workpiece former and the focused laser system.

4. The apparatus of claim 1, wherein the focused laser system further comprises a lens, and wherein the adjustment is made by moving the lens.

5. The apparatus of claim 1, further comprising:

a processor;

a memory; and

a set of instructions stored in the memory and executable by the processor to move the workpiece former and to cause the positioner to make the adjustment based on data stored in the memory that correlates the change in focal length from the focused laser system to the workpiece caused by carrier movement.

6. The apparatus of claim 1, wherein the focused laser system comprises at least one mirror to move the focused radiation beam over the surface of the workpiece when the workpiece former is in an operating position.

7. The apparatus of claim 1, wherein the positioner comprises a position sensing device and a motor.

8. The apparatus of claim 7, wherein the position sensing device is an optical sensor.

9. The apparatus of claim 7, wherein the position sensing device is an ultrasonic sensor.

10. The apparatus of claim 7, wherein the positioner operates in real-time to make the adjustment using input from the position sensing device.

11. An apparatus for modifying a rubber workpiece using a focused laser produced by a focused laser system, the apparatus comprising:

a workpiece former, the workpiece former being movable to a plurality of operating positions and having a complex shape to which the workpiece substantially conforms; and

a positioner comprising a position sensing device;

a processor;

a memory; and

a set of instructions stored in the memory and executable by the processor to move the workpiece former to an operating position and to cause the positioner to make an adjustment to the workpiece former to keep the focused radiation beam substantially focused on the workpiece as the workpiece former moves the workpiece former to an operating position that changes the distance between the workpiece and the focused laser system due to the complex shape of the workpiece, the adjustment being made using input from the position sensing device.

12. A method of modifying a thin, flexible workpiece that conforms to a workpiece former having a complex shape, the method using a focused laser produced by a focused laser system, the method comprising:

changing the positional relationship between the focused laser system and the workpiece former to establish a first operating position where the surface of the workpiece is substantially at the focal length of the focused laser where the focused laser meets the workpiece;

changing the positional relationship between the focused laser system and the workpiece former to establish a second operating position that changes the distance between the workpiece and the focused laser system due to the complex shape of the workpiece former; and

making an adjustment to keep the focused laser substantially focused on the workpiece at the second operating position.

13. The method of claim 12, wherein the adjustment comprises moving the workpiece former in a direction substantially parallel to an axis about which the focused laser is symmetric.

14. The method of claim 12, wherein the adjustment comprises moving the focused laser system in a direction substantially parallel to an axis about which the focused laser is symmetric.

15. The method of claim 12, wherein the adjustment comprises moving a lens in the focused laser system.

16. The method of claim 12, further comprising:

sensing the change in distance between the workpiece and the focused laser system caused by changing the positional relationship between the focused laser system and the workpiece former from the first operating position to the second operating position, wherein the adjustment is made in response to the sensed change in distance.

17. The method of claim 12, further comprising:

referring to data stored in a memory that correlates the change in distance between the workpiece and the focused laser system to motion from the first operating

position to the second operating position, wherein the adjustment is made in response to the data stored in the memory.

18. A method of producing a thin, flexible workpiece that conforms to a workpiece former having a complex shape, the method using a focused laser produced by a focused laser system, the method comprising the following steps in order:

moving the workpiece former into liquid rubber;

removing the workpiece from the liquid rubber and allowing the liquid rubber to dry on the workpiece;

changing the positional relationship between the focused laser system and the workpiece former to establish a first operating position where the surface of the workpiece is substantially at the focal length of the focused laser where the laser meets the workpiece;

activating the focused laser system;

changing the positional relationship between the focused laser system and the workpiece former to establish a second operating position that changes the distance between the workpiece and the focused laser system due to the complex shape of the workpiece former; and

making an adjustment to keep the focused laser substantially focused on the workpiece at the second operating position.

19. The method of claim 18, further comprising:

deactivating the focused laser system before establishing the second operating position; and

activating the focused laser system after the second operating position is established.

20. The method of claim 18, wherein the focused laser system remains activated as the positional relationship between the focused laser system and the workpiece former is changed.